SEMMMS A6 to Ringway Road West

B013 – Styal Mainline Over Bridge

Preliminary Design Report-Draft

Report No. 1007/7.04/093

January 2013

STOCKPORT METROPOLITAN BOROUGH COUNCIL

MANCHESTER CITY COUNCIL

Cheshire East Council

PRELIMINARY DESIGN REPORT

Structure Name: Styal Mainline Over Bridge

Structure Number: B013

Report No. 47060785-PDR-013

Report Control Sheet

Version	Date	Status	Prepared By	Checked By	Approved By
1	04/01/12	D	N.AFSHAR	T KSHIRSAGAR	N.SHEENA
2	9/05/2012	Draft (Final)	N. Afshar	N. Sheena	N. Sheena
3	24/01/2013	Draft (Final)	M Mfandarahwa	N Sheena	N Sheena

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EXECUTIVE SUMMARY

The preliminary design commenced with a desk study gathering all the relevant available information which could affect the design. Available geotechnical reports on the scheme were examined. Constant consultation with Stockport County Council and Network Rail enable us to thoroughly understand the constraints and to develop a viable engineering solution.

A number of possible options have been considered. The proposed structure will be a pre-cast pre-stressed concrete beam with reinforced concrete slab deck supported on abutments with wing walls. The bridge is simply supported with semi-integral construction to reduce maintenance problems.

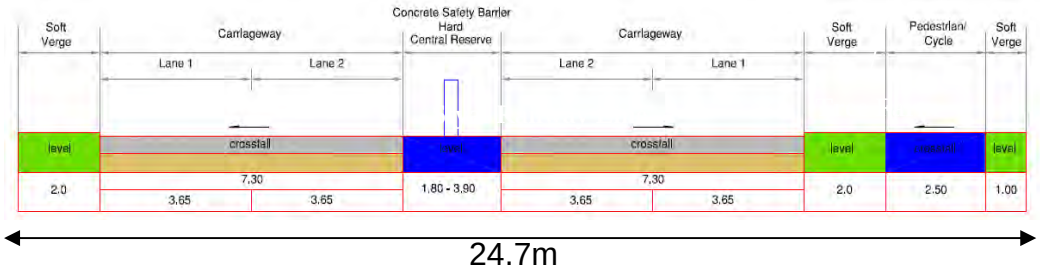
The principal constraint affecting the solutions is the track possessions times available. The available Rules of route possessions are from 22.40 to 05.40 on Tuesdays to Fridays for 9 weeks per year. There is also an additional 23.35 Saturday to 08.15 Sunday through out the year.

1. Description of Site

The Styal Mainline Bridge is part of the SEMMMS and is proposed to cross over the Styal Railway Line. The proposed road passes to the South of the Styal Electricity Sub-Station and located approximately 150m east of existing Styal Bridge at interchange 1925. There is a residential area 300m to the North of the proposed bridge crossing and a few residential houses to the South. The immediate surrounding area is open farm land to the West and to the East. An aerial location plan at 1:1250 scale with the bridge extents delineated in red is included in Appendix A.

2. High way Details

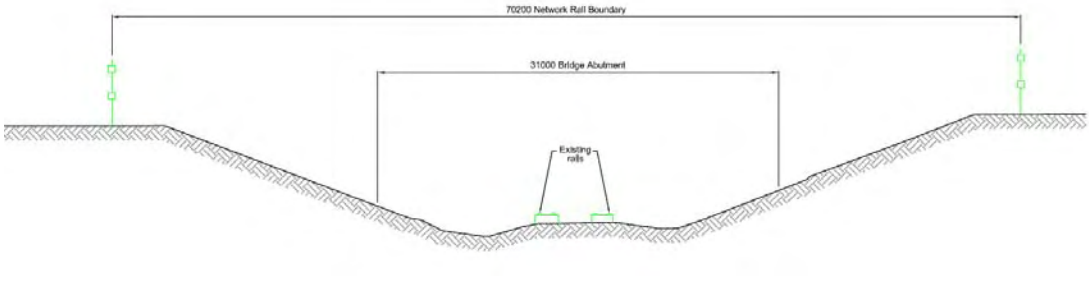
Over Structure – SEMMMS Relief Road (2.0m Soft Verge + 2 X 3.65m Carriageway, North), (1.0m Soft Verge + 2.5m Pedestrian/Cycle + 2.0m Soft Verge + 2 X 3.65m Carriageway, South) & 2.6m Safety Barrier Central Reserved.



Highway cross section over the bridge

3. Railway line

The Styal Railway is an electrified line and comprises of two tracks. At the crossing, the railway is in a cutting as shown below.



Railway cross section at the crossing

4. Proposed structure

Cost value analysis has been carried out for two different span configurations, 31.0m and 70.0m. Taking into account the capital costs, whole life costs and traffic management and access costs in accordance with BD36/92 the cost effective solution is a 31.0m single span simply supported semi integral bridge. The superstructure will be in the form of a composite pre-cast pre-stressed concrete beam and slab deck. The bridge superstructure will be supported on full height reinforced concrete abutments and wing walls on piled foundations. The square deck width including parapet up stands will be 24.7m. A General Arrangement drawing for the proposed structure is included in Appendix B.

5. Span arrangements

Single span of 31.0m measured between abutment faces. The skew angle is approximately 36.4 degrees. The abutments will be inside the Network Rail Boundary.

6. Headroom and Clearances

Taking into account the latest highway alignment and the proposed construction depth, the proposed headroom above the existing tracks is 7.0m. This is much greater than the headroom required above an electrified line. Therefore, there is a possibility for lowering the bridge and the embankments on both sides of the railway line. However, this needs to be confirmed by NR. The width of the Network Rail boundary is 70.0m. For any construction work inside the boundary, permission needs to be sought from Network Rail. However, the provided clearances are much greater than 4.5m a clearance that is usually provided. Therefore there is a scope to reduce these clearances in consultation with NR and as a result a smaller span could be accommodated.

7. Road Restraint system (Bridge Parapets)

Type N2 steel parapet with mesh infill is in accordance with Road Restraints Risk Assessment Process (RRRAP) and with TD 19/06. The system consists of 1.5m high safety barrier covered in steel units attached together to form a 1.8m high restraint system. The steel used is to BS EN 10025 and BS EN 10219. The standard finish is galvanised finish to BS EN ISO.

8. Possession times

Although accurate at present, possession opportunity is an initial guideline only and could change in future years. The available Rules of route possessions are from 22.40 to 05.40 on Tuesdays to Fridays for 9 weeks per year. In addition, 23.35 Saturday to 08.15 Sunday will be also available throughout the year. Making and allowance of 1.0 hour for handover and hand back to Network Rail, this will leave approximately 5.0 hours for productive work during the 9 weeks and 6.5 hours over the weekends.

9. Bridge Articulation

The deck will be simply supported with semi integral articulation sitting on bearings under each beam at both ends free at one end and pinned at the other end. Semi – integral construction will reduce maintenance problems from penetration of dirt, water and de-icing salts associated with expansion joints.

10. Preferred Structural Option

10.1 Superstructure

(Simply supported, semi-integral pre-cast pre-stressed Y beam and slab deck):

Please also refer to drawing No 713 and the 3D model in Appendix B.

For a span range of 15m to 35m, pre-cast prestressed beam construction is normally considered a cost effective solution.

The advantages for using pre-cast concrete beam construction are as follows:

- Low capital & whole-life cost
- Good aesthetics due to symmetrical structure
- Fast and efficient build
- Factory quality with engineered tolerances
- Low maintenance
- Environmentally friendly
- The beams could be lifted individually
- Permanent formwork provides self supporting system during construction and eliminates false-work
- The beams are spaced apart, facilitating easy access to the underside of the structure
- Reduces site works which is weather dependent

Disadvantages:

- Precast concrete beams are usually heavier than comparable steel beams. As a result bigger cranes might be required to lift the precast concrete beams
- Heavier superstructure mentioned above might lead to bigger foundation sizes
- Delivery times are dependent on specialist supplier

10.2 Substructure Options

(In-situ concrete wall abutment with wing walls)

Considering the topography of the site, existing ground level and the feasibility of the work, a full height concrete abutment is the best possible option.

Taking the geotechnical information into account, piled foundation would be a suitable foundation solution in order to reduce settlements from the embankment and bridge loading, which could affect the track and track bed. Further geotechnical discussion is included in section 12 of this report.

11. Construction Sequence

As mentioned before, for any construction work inside the NR boundary, appropriate procedures have to be in place which should satisfy NR requirements in advance of the works. However, parts of the work might be undertaken while the services are running as the proposed substructures are set much greater than 4.5m away from the tracks.

Stage 1 Without ROR possessions

- Install safety screens
- Construct piling platform
- Install bored piles for the abutments and wing walls
- Construct the reinforced concrete abutments and wing walls.
- Set the bearings in place

Stage 2 During the blockade of the railway

- Lift in the precast prestressed beams with the permanent formwork and erect safety screens.
- Construct the insitu concrete deck
- Install the high containment parapets (H4a)

12. Geotechnical Information

The ground conditions for the Styal Railway Bridge have been assessed using relevant geological maps (Stockport Sheet 98, Solid and Drift Scale 1:50,000) only as no ground investigation has been carried within at or within the vicinity of the proposed structure.

12.1 Ground Conditions

The ground conditions indicated on the geological maps identify drift deposits of Boulder CLAY of Recent and Pleistocene age overlying 'Keuper' SANDSTONE over Upper Mottled Sandstone, which are both part of the Sherwood Sandstone Group.

A large fault is indicated cut to the west side of the railway line, which could mean that the Southbound carriageway is underlain by 'Keuper' Marl rather than Sandstone.

Without ground investigation information it is not possible to know the thickness of the drift deposits, but from investigations undertaken to the east and west along the route Boulder Clay/Glacial Till deposits are indicated to have thicknesses of between 5 and 10m.

12.2 Groundwater

There is no known groundwater information for the site.

12.3 Preliminary Geotechnical Assessment

Without any detailed information known about ground conditions within this area it is anticipated that piled foundations would be an appropriate foundation solution. The length of the piles would need to be confirmed after detailed ground investigations have been carried out and the design undertaken by the pile designer.

The potential for chemical attack on buried concrete within the ground has not been assessed. This will be the responsibility of the foundation designer, following a supplementary ground investigation.

Investigation into the groundwater levels and changes with seasons, along with flow rates is recommended for the design and drainage methods, along with any required temporary mitigation measures during construction.

Geotechnical information is not available and therefore it is recommended to undertake geotechnical survey of the site.

13. Environmental Impact Considerations

Generally surroundings at the site are open fields apart from the Electricity sub-station to the North. Except from the existing Styal Bridge is about 100m away to the West of the site, the visual impact is minimised. The main environmental impact of the crossing is likely to be on a number of residential premises located about 300m to the North of the bridge. Given the current aspects from these properties, their distance from the site and considering the fact that the area is surrounded with trees and other vegetation, there will be minimal visual impact. If required, noise barriers can be installed, which can be determined in the feasibility stage.

There are other areas in which the scheme will have an environmental impact such as ecology, air quality, transport, hydrology, ground contamination, archaeology, and drainage.

14. Appearance

Above the ground level most structural elements are going to be visible at this location. The proposed superstructure will obviously be visible. On elevation comprises of approximately 1.4m deep pre-cast prestressed beams and 0.5m string course spanning across Styal Railway Line. In addition, 1.8m H4a solid steel parapets will be mounted on the string courses either sides of the bridge. The bridge approaches will be carried on approximately 2.0m of embankments on either side of the railway line. Parts of the abutments and wing walls which are of concrete finish would be visible. Brick facing of the visible parts of the abutments and wing walls can be considered to improve the visual impact.

Appendix A: Location Plan

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semms

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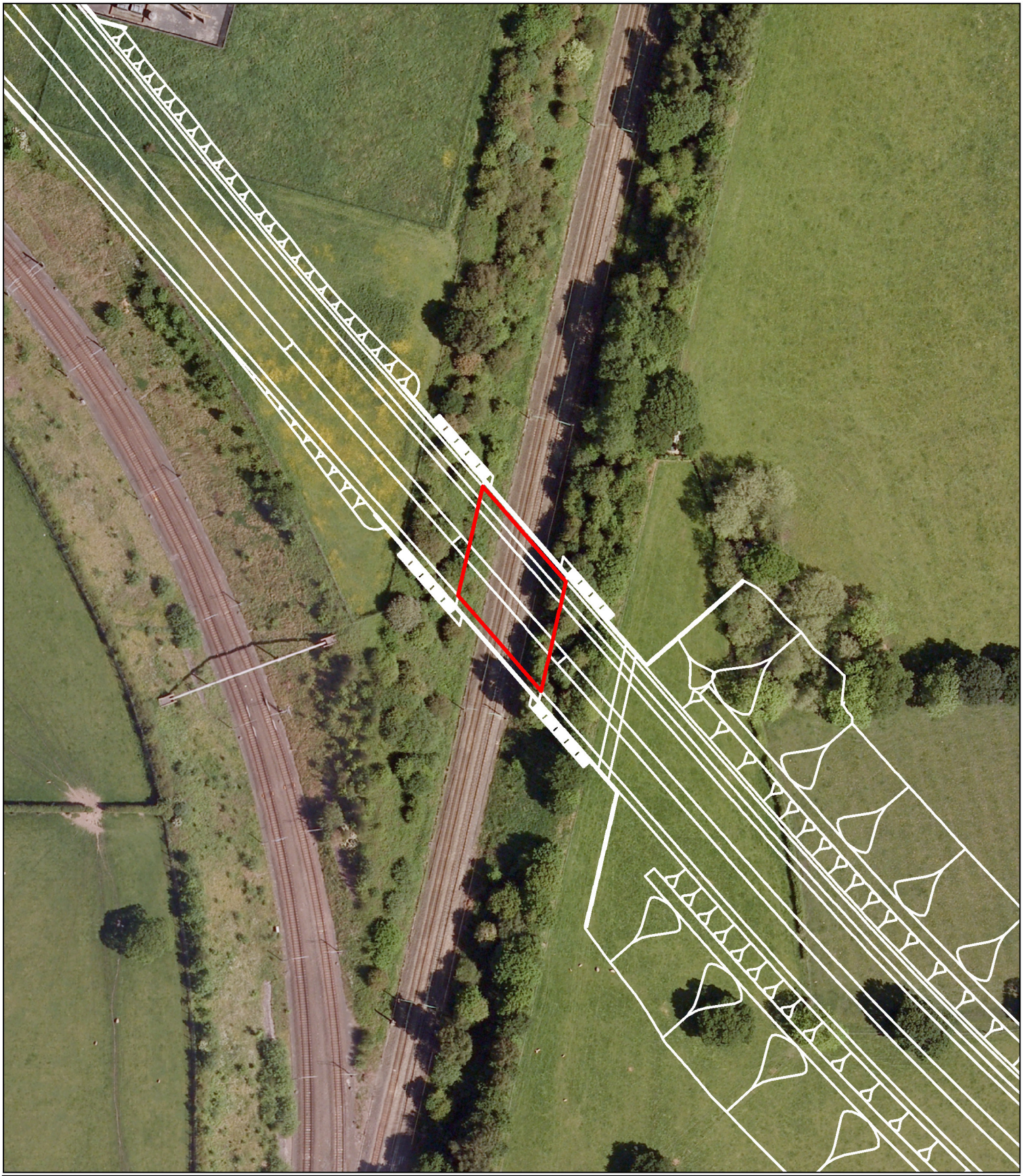
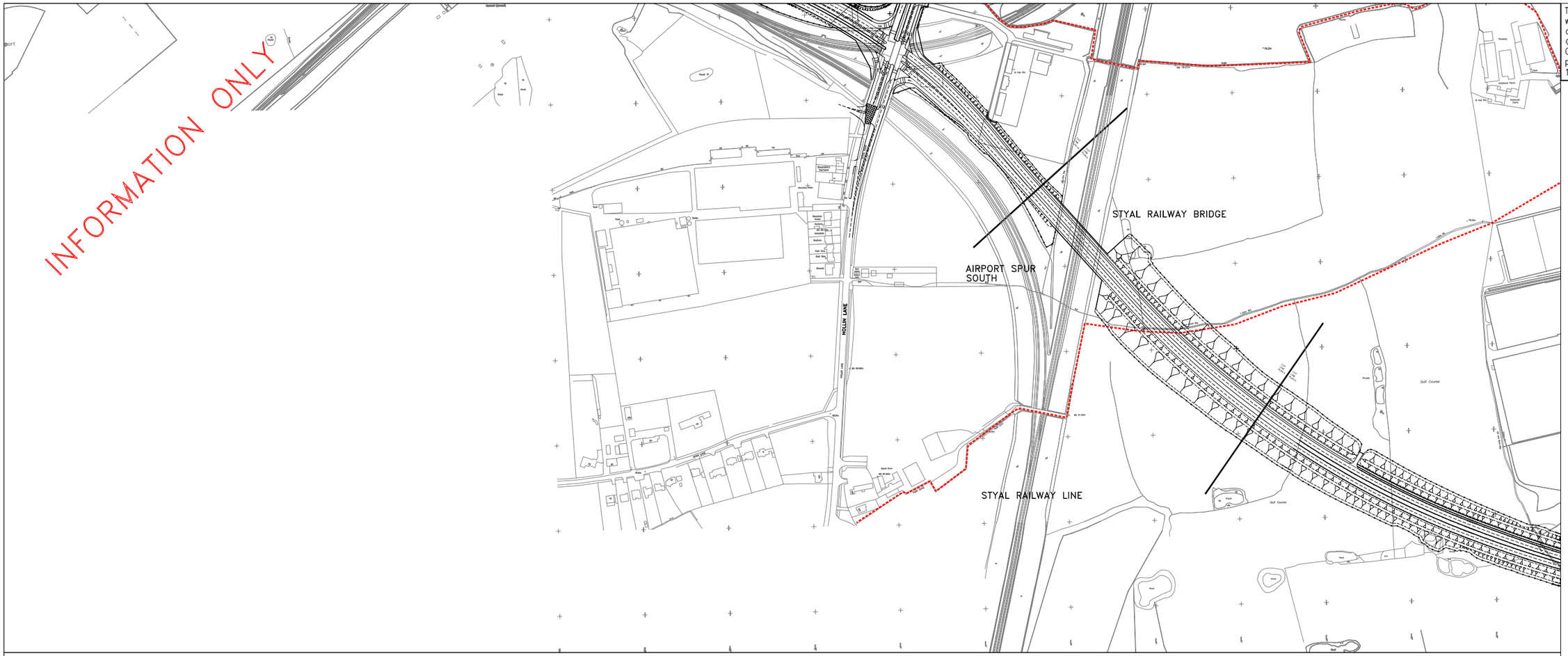
bluesky

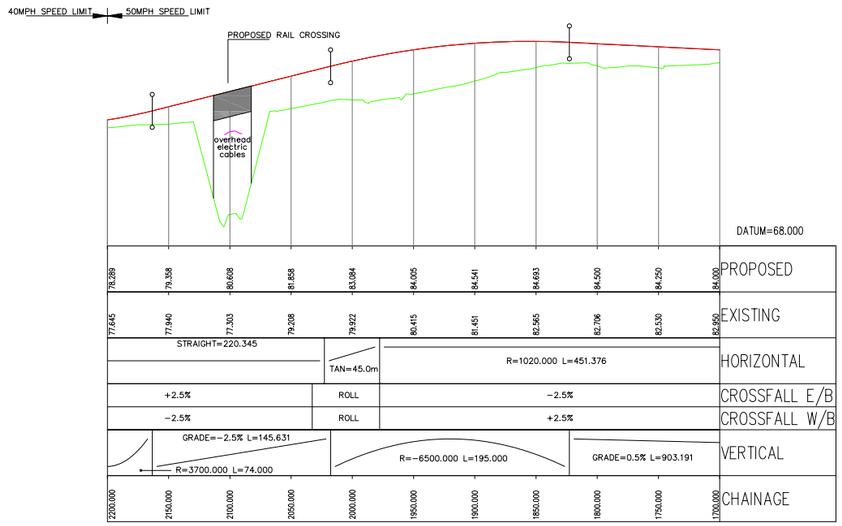


Drawn	CL	Checked	AB	Approved	
Date	17/01/12	Date	17/01/12	Date	
Size	A4	Scale	1 : 1,250		NORTH
GIS Task	3788_13	Filename			
Drawing No.	1007-3D-DF5-A6-MA-B013-ALP			Revision	



KEY

- EXISTING DEFINITIVE PROW
- EXISTING NON-DEFINITIVE PROW
- EXISTING BRIDLEWAY



SECTION ALONG CENTRELINE OF SEMMMS RELIEF ROAD
STYAL ROAD TO MANCHESTER INTERNATIONAL AIRPORT
(SPEED LIMIT 40MPH/50MPH)

Rev.	Drawn	Checked	Date	Revision Details
A	SP	NH	30.03.11	VERTICAL ALIGNMENT REVISED

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semmms

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Job Title

SEMMMS
RELIEF ROAD SCHEME
A6 - AIRPORT

Drawing Title

DRAFT DESIGN FREEZE 5
GENERAL ARRANGEMENT
SHEET 9 of 12

Drawn	Engineer	Checked	Approved
SP	SP	NH	MPR
Date	Date	Date	Date
05/05/11	10/06/11	13/06/11	13/06/11

Size: A1

Scale: PLAN 1:2500 – SECTION HZ 1:2500, VT 1:250

SCG No.

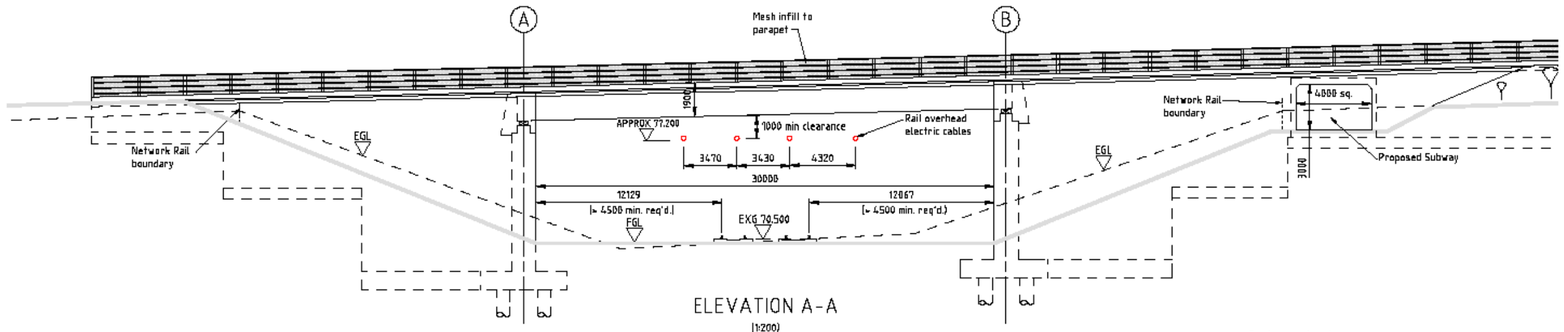
Filename: S:\Projects\SEMMMS Major Information\6.0 Highways\6.3 Geometry and Survey

Drawing No.: 1007/3D/DF5/A6-MA/GA/508

Revision: A

Appendix B: Proposed General Arrangement drawing

3D Model



ELEVATION A-A
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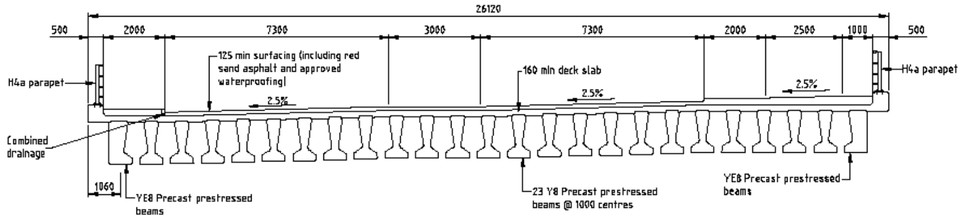

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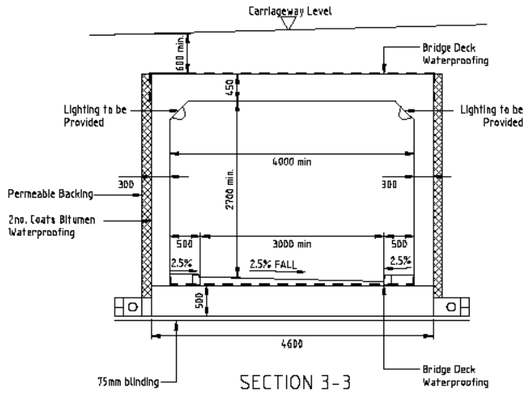

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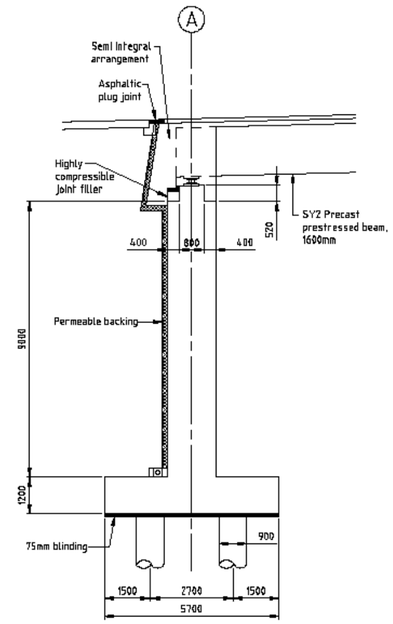

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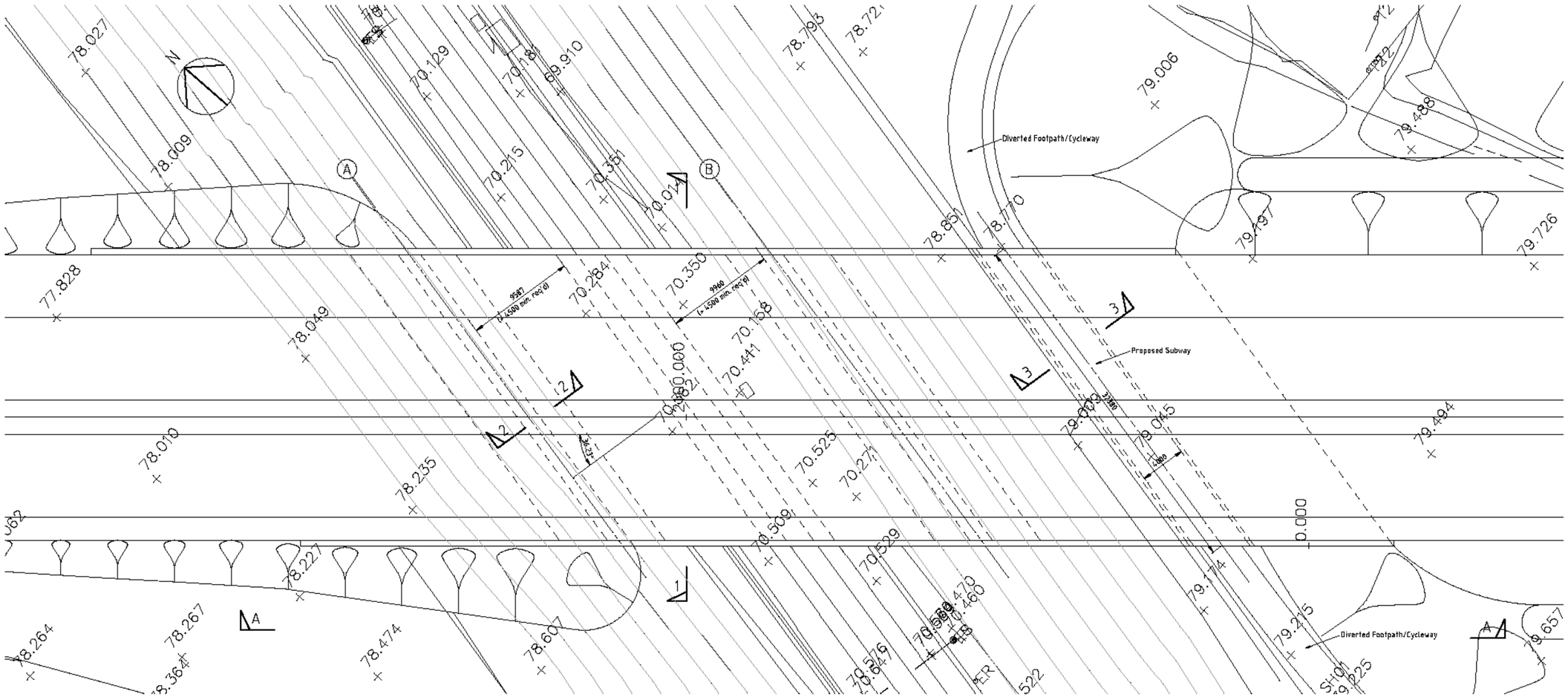

PLAN
(1:200)

NOTES

1. This drawing has been produced based on the latest MX highway model - Draft Design Freeze 5, as provided by the client (Feb. 2013).
2. This drawing has been produced mainly for the purpose of preliminary design.
3. Levels are in metres and above Ordnance Datum.
4. All dimensions are in millimetres.
5. The option shown in this drawing is not for construction
6. The foundation type shown on the drawing is based on the latest available geotechnical information.
7. Basic preliminary design has been undertaken to determine the geometry of the section sizes as per client's instruction.
8. Concrete strengths:-

Precast panel	C32/ 40
Secant piles	C32/ 40
Abutment diaphragm	C32/ 40
Deck slab	C32/ 40
Parapet edge beams	C32/ 40
Precast beams	C50/ 60

9. Permanent formwork is required.
10. Concrete finishes to be as per MCHW specification series 1700 U.N.O. :-

Buried foundations :	F1, U1.
Abutment columns :	F1.
Buried face of abutment :	F1.
Waterproofing :	F4.
Precast beams :	F5.
Precast concrete panel	F4,
Parapet edge beam :	F3, U3.
Deck slab top surface :	U4.

Rev.	Drawn	Checked	Date	Revision Details
03	LF	MM	12/04/13	SUBWAY DETAILS ADDED
02	SPH	MA	18/03/13	REVISED INCORPORATING CLIENTS COMMENTS
01	SPH	NS	15/5/12	Elevation amended.

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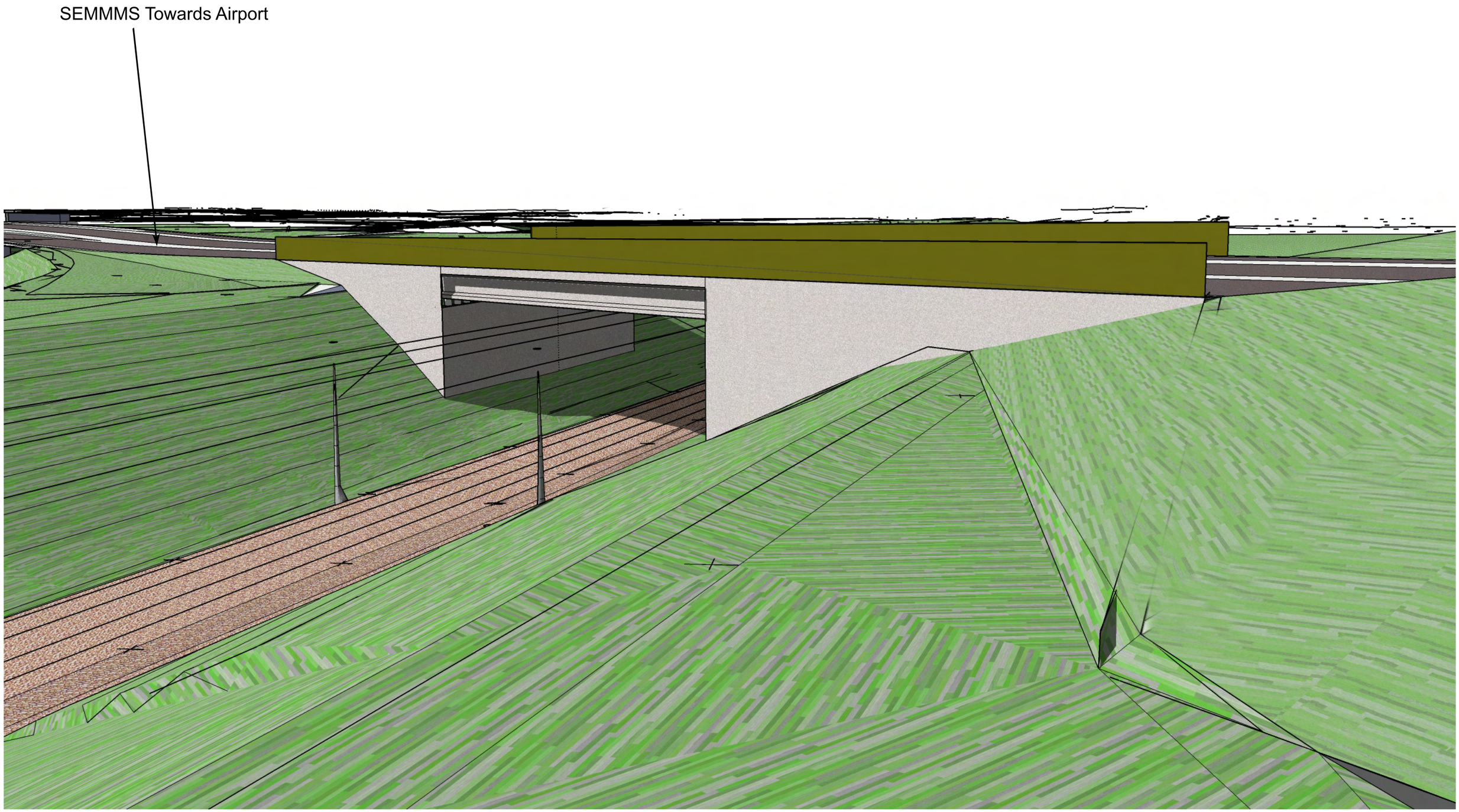
Job Title

SEMMMS
RELIEF ROAD SCHEME
A6 - AIRPORT

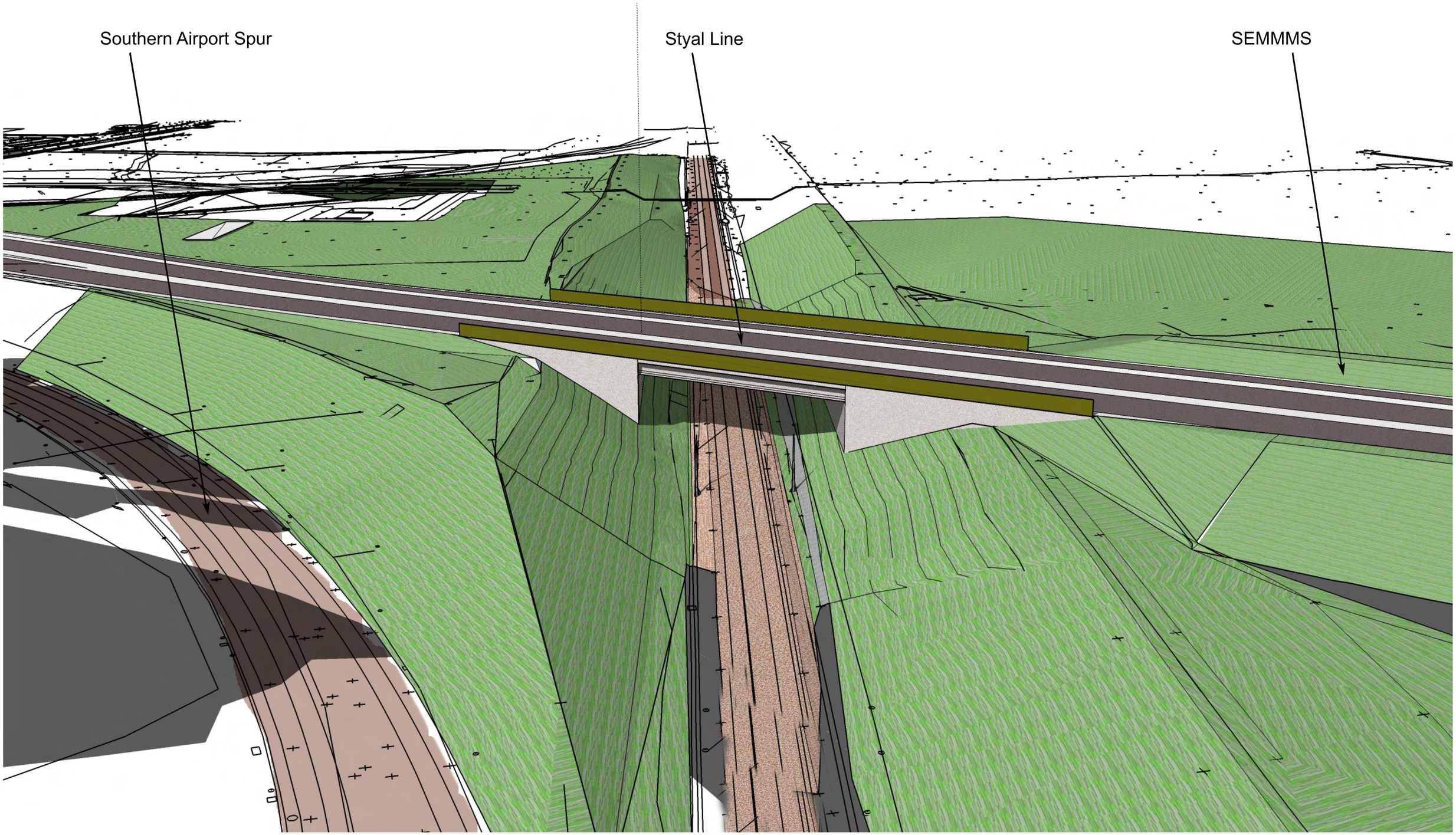
Drawing Title

STYAL RAILWAY BRIDGE
GENERAL ARRANGEMENT

Drawn	Engineer	Checked	Approved
JMcC			NS
Date DEC '11	Date	Date	Date DEC '11
Size A1	Scale AS SHOWN		
SCG No.	Filename		
Drawing No. 1007/3D/DF5/A6-MA/B013/713			Revision 03



Styal Railway Bridge
Elevation from South East Embankment



Styal Railway Bridge
View Looking North

Appendix C: Geotechnical Information

Information is not available- Geotechnical survey is recommended